FI.ICT-2011.1.8 FINESCE

D6.4 Ver 1.0

FINESCE Roadmap

Contractual Date of Delivery to the CEC:	*September 30, 2013*
Actual Date of Delivery to the CEC:	October 4, 2013
Author(s):	Julian Krenge, Marco Roscher
Participant(s):	FIR
Workpackage:	*WP6 – FI in Energy Business Innovation*
Estimated person months:	4
Security:	CO = Confidential, only for members of the consortium (including the Commission Services)
Nature:	R = Report
Version:	1.0
Total number of pages:	16

Abstract:

This document describes the current status and planned development of Work Packages 1 – 5 in terms of their used external technologies, Generic Enablers, planned developments and innovations. Goal is to give a consistent and concise overview over the plan within the different trial sites and to allow for the identification of FINESCE-internal synergies as well as to inform project-external parties.

Keyword list:

Trial architecture, trial sites, Future Internet, Generic Enabler, exploitation, roadmap

Executive Summary

The purpose of the FINESCE roadmap is to identify and document key use cases and innovations. All developments belonging to the individual Work Packages are to be analysed and a draft of a vision for future applications from a customer perspective to be developed. Furthermore, the planned deployment of external technologies within the architectures of the Work Packages – first and foremost the Generic Enablers of the Future Internet – is to be analysed and documented.

The FINESCE roadmap is an activity accompanying the setup of the trial architectures within the different Work Packages. This means, that this document and the roadmap will experience further iterations along the course of the project. In a first step – which is described in this document – individual roadmaps on WP-level are documented, describing the WP-internal innovations, developments and external technologies. This status will evolve as the Work Packages further investigate the Generic Enablers and their possible deployment in the trial architectures.

Primarily, the roadmap aims to coordinate trial site activities and goals. Additionally, this report is used as input for the student case competition and open calls for Innovation and Business Impact. It also illustrates FINESCE objectives and strategies for FI-PPP phase 2, and provides support for Smart Utility Future Internet-based applications in phase 3 and beyond.

Authors

Partner	Name	Phone / Fax / e-mail
FIR	Julian Krenge	Phone: +49 241 47705 - 504 Fax: +49 241 47705 - 199 e-mail: Julian.Krenge@fir.rwth-aachen.de
	Marco Roscher	Phone: +49 241 47705 - 511 Fax: +49 241 47705 - 199 e-mail: Marco.Roscher@fir.rwth-aachen.de

Table of Contents

1. Introduction

1.1 Purpose of this report

The purpose of the FINESCE roadmap is to identify and document key use cases and innovations. All developments belonging to the individual Work Packages are to be analysed and a draft of a vision for future applications from a customer perspective to be developed. Furthermore, the planned deployment of external technologies within the architectures of the Work Packages – first and foremost the Generic Enablers of the Future Internet – is to be analysed and documented.

The FINESCE roadmap is an activity accompanying the setup of the trial architectures within the different Work Packages. This means, that this document and the roadmap will experience further iterations along the course of the project. In a first step – which is described in this document – individual roadmaps on WP-level are documented, describing the WP-internal innovations, developments and external technologies. This status will evolve as the Work Packages further investigate the Generic Enablers and their possible deployment in the trial architectures.

1.2 Scope and target audience of this report

Primarily, the roadmap aims to coordinate trial site activities and goals. Additionally, this report is used as input for the student case competition and open calls for Innovation and Business Impact. It also illustrates FINESCE objectives and strategies for FI-PPP phase 2, and provides support for Smart Utility Future Internet-based applications in phase 3 and beyond.

1.3 Relationship to other and previous work

The work documented here is performed in context of Task 6.2. It uses the deliverables D1.1, D2.1, D3.1, D4.1 and D5.1 as input and initial starting point for the formulation in the roadmap. In further steps, the roadmaps have been refined, extended and aligned in workshops with the Work Package teams.

2. Roadmapping methodology

2.1 Objective

The objective of the FINESCE roadmap is first to identify and gather interdependencies of technologies, competencies and resources on the one hand and products, services as well as internal and external drivers on the other hand. Second goal is to create a mutually awareness of general activities and developments taking place within all trial sites and synchronize research and approaches, with the aim of enhancing cross-WP communication from the beginning and to pursue a common approach strategy regarding upcoming similar tasks, and to foster communication and interdisciplinary cooperation.. Additionally, intended cross work package interactions shall be supported and documented.

2.2 Methodology

The FINESCE roadmap mainly consists of three individual layers. **Fehler! Verweisquelle konnte nicht gefunden werden.** gives an overview over the structure and the content of the different layers. The top layer I “Core Innovations” documents key innovations and use cases as well as external market drivers, such as legal or regulatory changes and shifts in consumer behaviour or needs. The middle layer II “Applications/Services” depicts all the developments performed within the WP, including developed applications and services, established architectures and concepts, specifications and standards and other solutions required to achieve the key innovations. The bottom layer III “Technologies” shows any external

technologies – especially Generic Enablers – to be used within the trials. Hence this layer gathers all out-of-the-box solutions and already existing results to be deployed and used.

Graphically, the roadmaps are made up of three layers populated with white blocks. The size of the blocks generally correlates to their respective importance. Non-white blocks are either green, marking them as generic enablers, or blue, marking them as external market drivers.

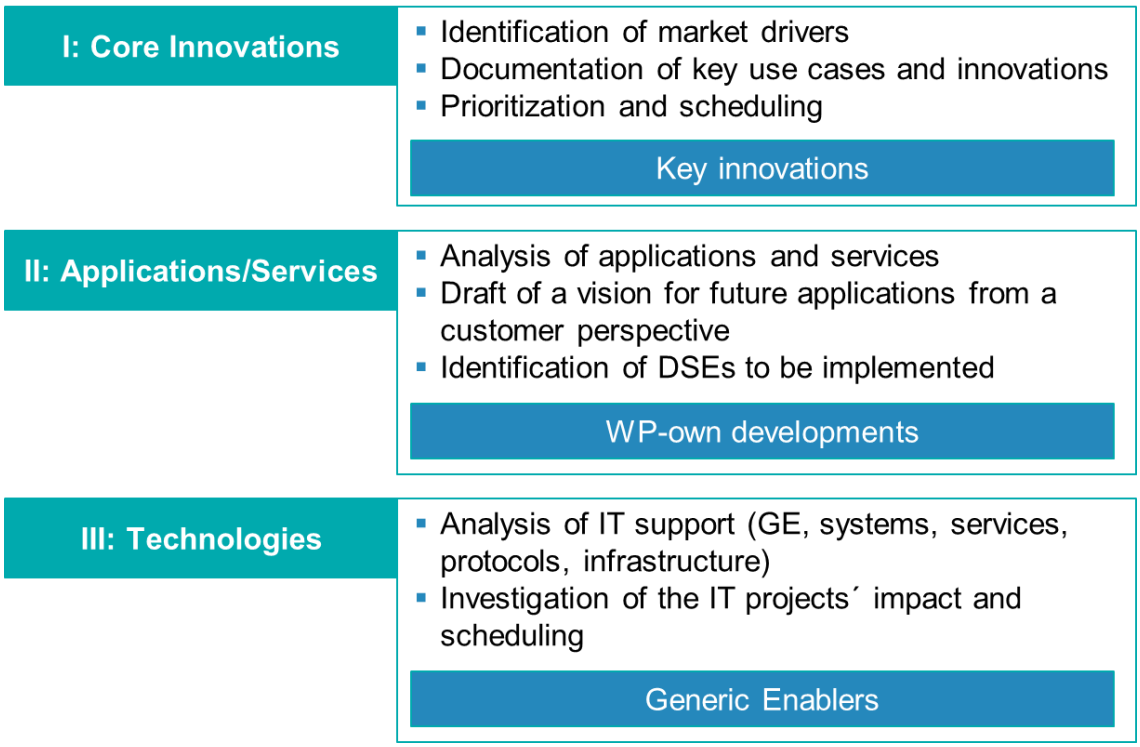


Figure 1: Structure of FINESCE roadmap

The described three layers of such a roadmap are further interconnected. Arrows between the elements in each of the layers – namely innovations, applications/services or technologies – illustrate interdependency between those elements. E.g. an arrow showing from a technology to an application/service represents that this technology is used for the application/service pointed at. Further, applications/services can build on each other or enable an innovation. Generally speaking, an arrow going from element X to Y means that X is required for Y.

The last important aspect of the roadmap is an additional column to the very right of the roadmap. Here, any future (e.g. FI-PPP phase 3) developments and targets can be documented.

2.3 Timeline for FINESCE Roadmap

To create the FINESCE Roadmap, two steps are taken. First, individual roadmaps for each of the Work Packages (or stream within a Work Package) have to be set up. This allows a faster and more targeted approach in creating the roadmaps. The result of this step is documented in this deliverable. Secondly, the individual roadmaps are consolidated and combined in order to identify possible synergies in the developments of the different WPs, which will be delivered in month 18.

Aside from this two-step-approach the roadmaps of each of the WPs are subject to continuous change. In the process of evaluating the GEs and their possible deployment and implementation for the trial architectures, their integration into the architecture might shift, additional GEs might be required or originally planned ones become obsolete. This means that the roadmaps need to be continuously updated.

Initial workshops for each trial site with key partners took place at the trial sites to develop an overview regarding market drivers, available external technologies and applications and developments. An outline of market drivers, applications/services as well as external technologies with their interdependencies was developed. Information regarding risks and possible problems as well as interdependencies and tasks for necessary WP-internal implementations/developments to achieve the trial site specific targets were documented.

The current document hence reflects step 1 of the process in creating the FINESCE roadmap: individual roadmaps for each of the WP. This status will be updated in month 18, when interdependencies and connections will be once more verified and reviewed. Additionally, high-level elements of the roadmap, such as overlaps or interferences, will be identified and synchronization will be performed. This will results in the FINESCE roadmap.

3. Roadmaps

3.1 WP1: FI providing the sustainable smart city energy eco-system

External technologies used in WP1 include a Home and a Building Management System as well as external data sources such as weather, price and grid data. Additionally, the generic enablers Data Context, CEP, Big Data as well as Access Control and Identity Management are used.

Both, Management Systems as well as external data sources along with a Load Forecast are necessary to establish the Portfolio Manager. For the API Proxy and Management of Access Control GEs are deployed. The Portfolio Manager in turn feeds the API Proxy, Data Center, Analytics and the Development of Optimization Algorithms. Finally, Products and Services include a Proof of Concept and Scale-Up Strategy, Visualisation as well as 3rd Party Services and Apps (phase 3).

Optimization Algorithms lead to Cost Optimization by Price Signals and Optimization of demand by energy mix signals, resulting in optimized usage of energy. External market drivers include climate contracts, commitments to owners, market interest and political targets.

WP1 builds on existing technology for smart homes and supplements them with Future Internet technologies to build the technical foundation for business models exploiting the flexibility of private household energy consumption. The optimization algorithms and methods can create a viable business model by means of demand side management.

3.2 WP2 Stream 1: FI for end users of energy eco-systems, Smart Region

External Technologies used in WP2 include multiple smart meters (heat, electricity) and sensors air quality), as well as supply technologies and EVs. External data sources provide information about weather, price, grid data, etc. Generic Enablers in WP2 include Context Broker, Gateway Device Management, Gateway Protocol Adapter, Gateway Data Handling, Access Control and Identity Management.

Products and Services in WP2 are implemented via the following eight steps: Initial Structural Trial, Integration of House Controller, Integration of Physical Equipment, Integration of External Data Sources, Performing Remote Control, Integration with GEs, Testing Algorithms (Prosumer and Micro Grid Algorithm) and finally an API Test.

Baseline Measurement starts after step three, enabling information about energy consumption to residents and triggering user involvement as market driver. Following step five, the smart grid is launched and roll-out of EVs begins. Phase 3 consists of peak load shaving in the electrical grid, building and validating forecast profiles as well as smart grid functionality for OEMs.

The system deployed in the smart region is a key aspect in terms of the integration architecture of several different technologies and Generic Enablers. As higher flexibility by prosumers will be

required to allow for decentralized energy production, WP2 Stream 1 will show the technical feasibility of such infrastructures.

3.3 WP2 Stream 2: FI for end users of energy eco-systems, Smart Building

Generic Enablers used in WP2 Stream 2 include Location, Big Data Analysis, Data Handling PLL, Publish/Subscribe Context Broker and Context Awareness Platform. Additional external technologies are Meters, Gateways, Power Analysers, Sensors, Root Nodes, Weather Services and the building blocks of a micro-grid. Those include Solar Panels and Wind Power Emulators / Modules, Inverters, Electronic Storage Systems and Loads.

Afterwards, these external technologies are combined to make up the Building Control Centre (monitoring and concentrating energy information of different buildings), a Wireless Sensor Network (as physical implementation of all devices), the already-mentioned Micro-Grid (integrating technology to develop monitoring and management applications) as well as a Weather Forecasting (developing new products from already developed software).

WP2 Stream 2 drives existing technology for smart office buildings one step further and shows close-to-market solutions, which can already actively support building management.

3.4 WP3: FI developing the B2B energy ecosystem

Apart from the Generic Enablers IoT, CEP, App Mashup and Security, the only external technologies used in WP3 are Modbus / Profinet, Metering Technology and Fiber to the Cloud.

The ability to connect a variety of different machines and DERs is part of the main Products and Services developed within this WP. Other important developments in this context are an adequate Data Aggregation and Identity Management as well as the deployment of an API for use with 3rd Party Services and Apps. Furthermore, a Cross-Border VPP Manager is developed and Grid & DER Simulation takes place.

Manufacturing Event Handling with an integrated Energy Efficiency Evaluation and combined with the flexible energy prices provided by cross-border VPP management, will support a higher use of renewable energy in manufacturing. For the VPP, regulations and business profitability are the main obstacles to full market exploitation. The ICT infrastructure developed within WP3 allows for the management of such a VPP. The smart factory performs a field study of the potentials of load shifting in discrete manufacturing. Given the current legal and economic circumstances, such solutions will not be deployed in the near future.

3.5 WP4: FI building the Energy Marketplace

External Technologies in use for WP4 include only Generic Enablers: Context Broker, Big Data Analysis, CEP, App Mashup, Data Handling and Security.

A combination of the Context Broker, Big Data Analysis and CEP GEs allows in a first steps the processing of several kinds of data like social events repository, weather data, metering data, energy dynamics and contract information and thus form the starting point for all Products and Services of this WP. Through the integration of subjective data, an issue detector, regulation compliance and contract management as well as Integration of a Contract Manager and Interactive marketplace as interface to end-users is developed. Additionally, validation takes place and an API is developed .

Market-side components include external drivers such as EU 2020 Targets as well as the minimization of grid instability, increased demand flexibility, income maximization on both retailer and consumer side as well as prosumer involvement. Finally, to increase the usage of renewable energies, a new aggregator business model for the energy market emerges.

WP4 investigates the possibilities of an energy marketplace in the area of the distribution grid. The trial investigates the technical feasibility and potential use cases of such an approach to validate the market application.

3.6 WP5: FI in electricity in action

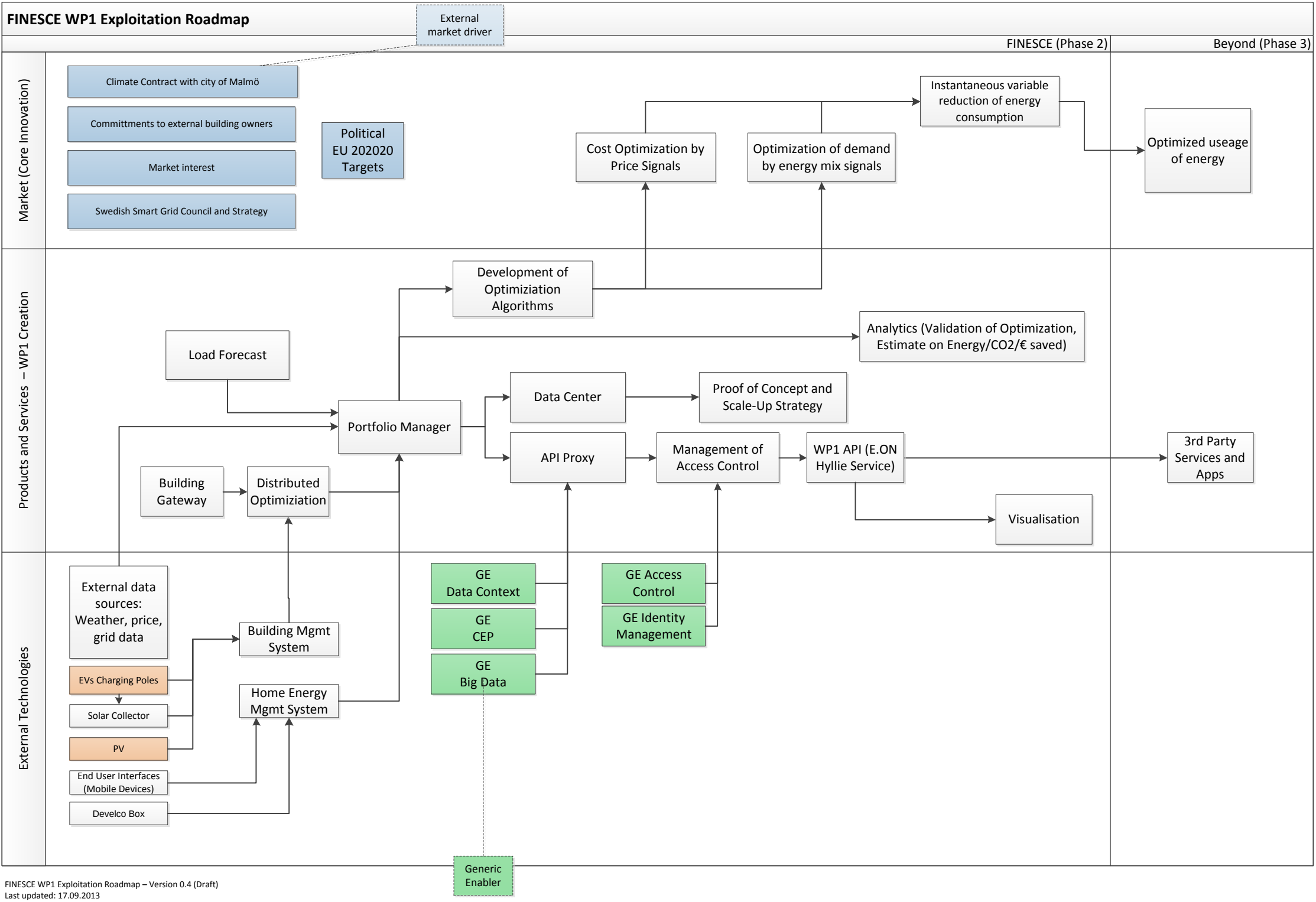
Usage of external technologies in WP5 includes GEs such as Cloud Edge and Authentication or other from the Security technical chapter as well as Data Connections, Weather forecasts as well as Distribution PQ Monitors and Smart Charging Stations.

To optimize EV Charging, Renewable Supply Forecasts as well as an Integrated System comprised of a Charging Management System, Distribution DR Management and Smart Grid Communication Network is used. Additionally, Inter-Substation Communication and an API for remote controlled Charging and possible 3rd Party Services and Apps are developed.

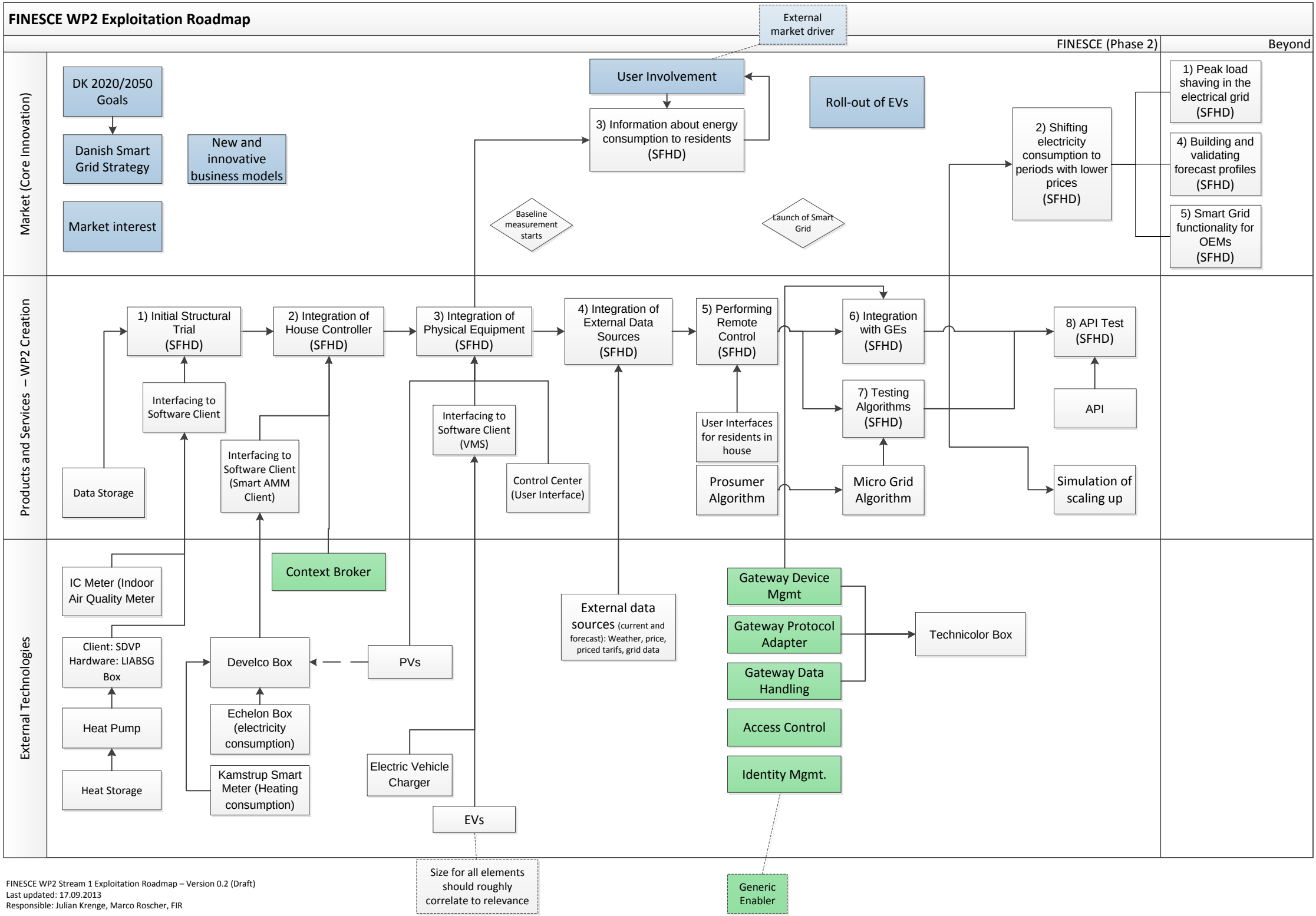
The Market's target of Local Balancing is implemented via EVs in the grid and Grid Anomaly Handling through Auxiliary Grid Services. In phase 3, this could lead to an automated grid leaning towards 100% Renewables.

The WP5 solution has three major dependencies for market exploitation: First, sufficient EVs need to be in use in a region that they have an effect if they are controllable by an energy provider. The second dependency is market acceptability of the service by the customers. This dependency is on the profitability of the service.

FINESCE WP1 Exploitation Roadmap

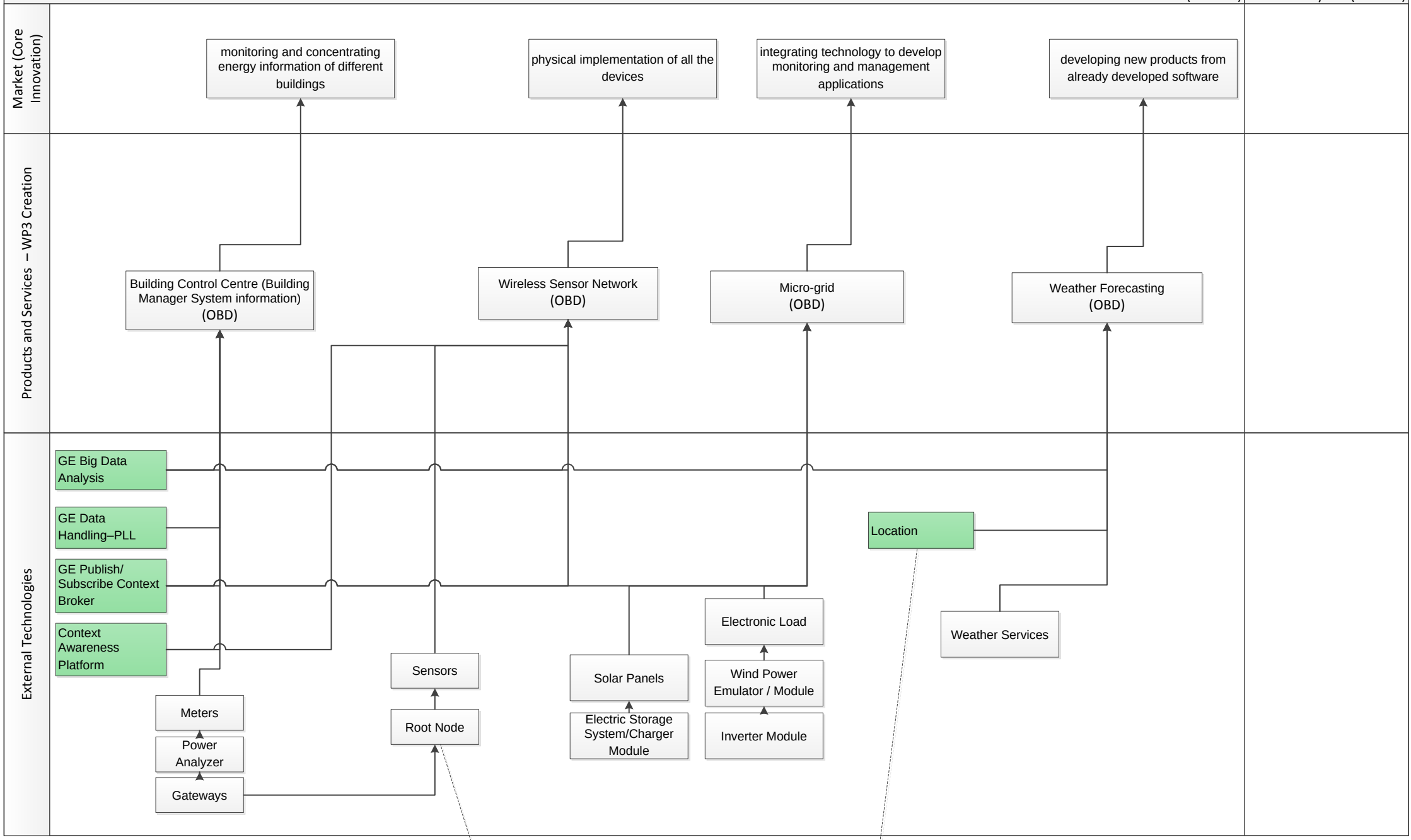


FINESCE WP2 Exploitation Roadmap

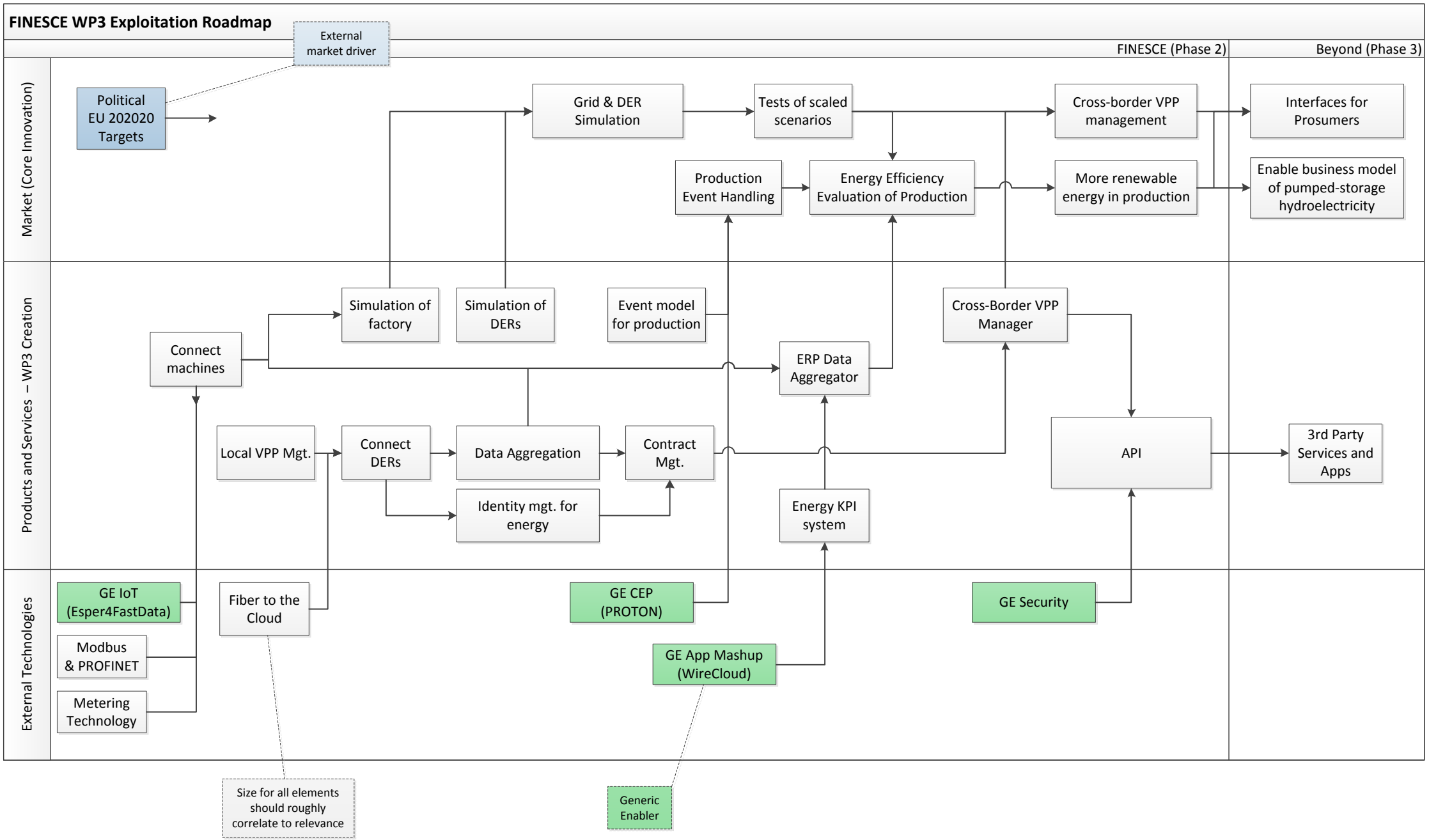


FINESCE WP2 Stream 1 Exploitation Roadmap – Version 0.2 (Draft)
Last updated: 17.09.2013
Responsible: Julian Krenge, Marco Roscher, FIR

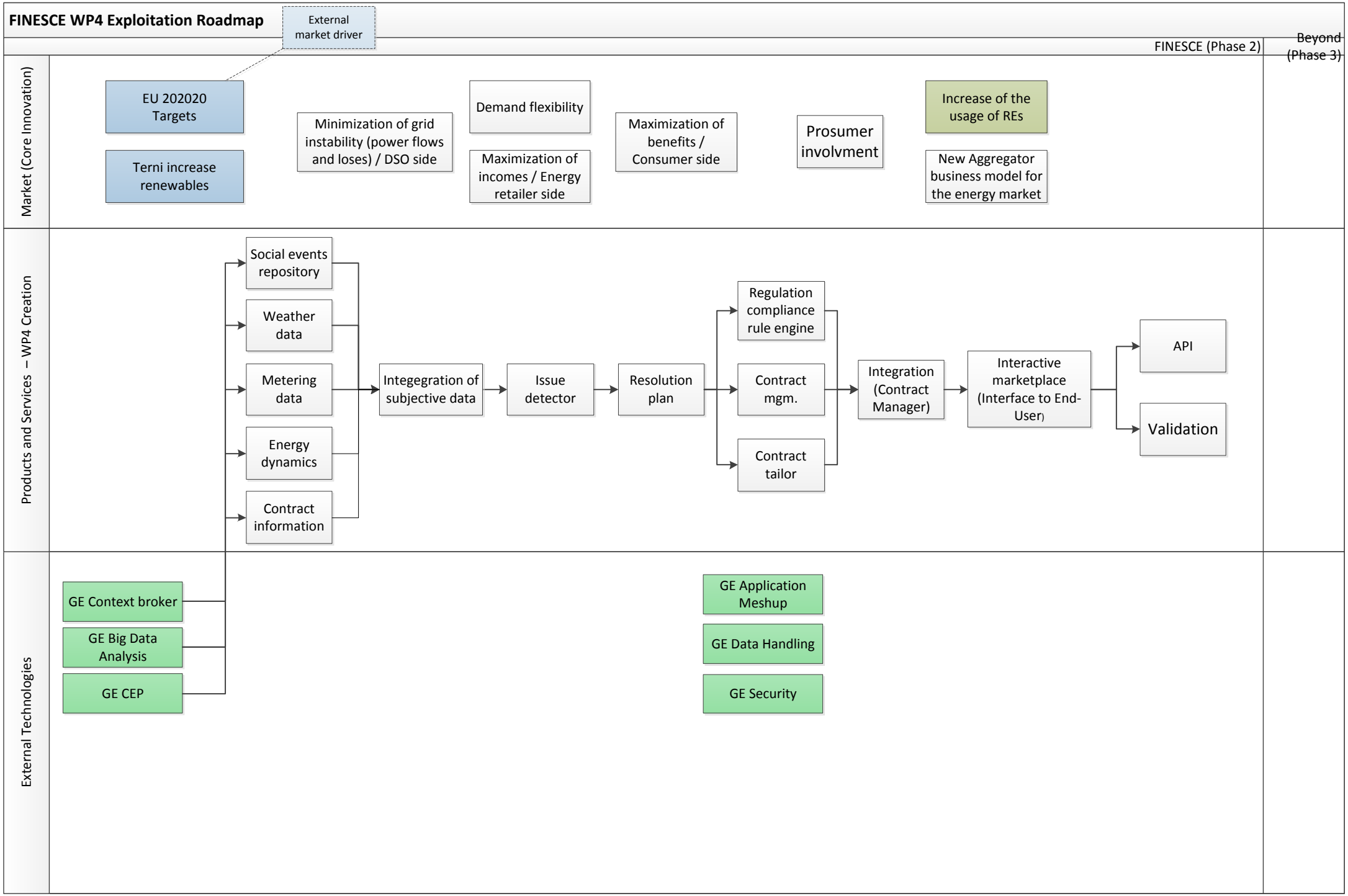
FINESCE WP2 Exploitation Roadmap

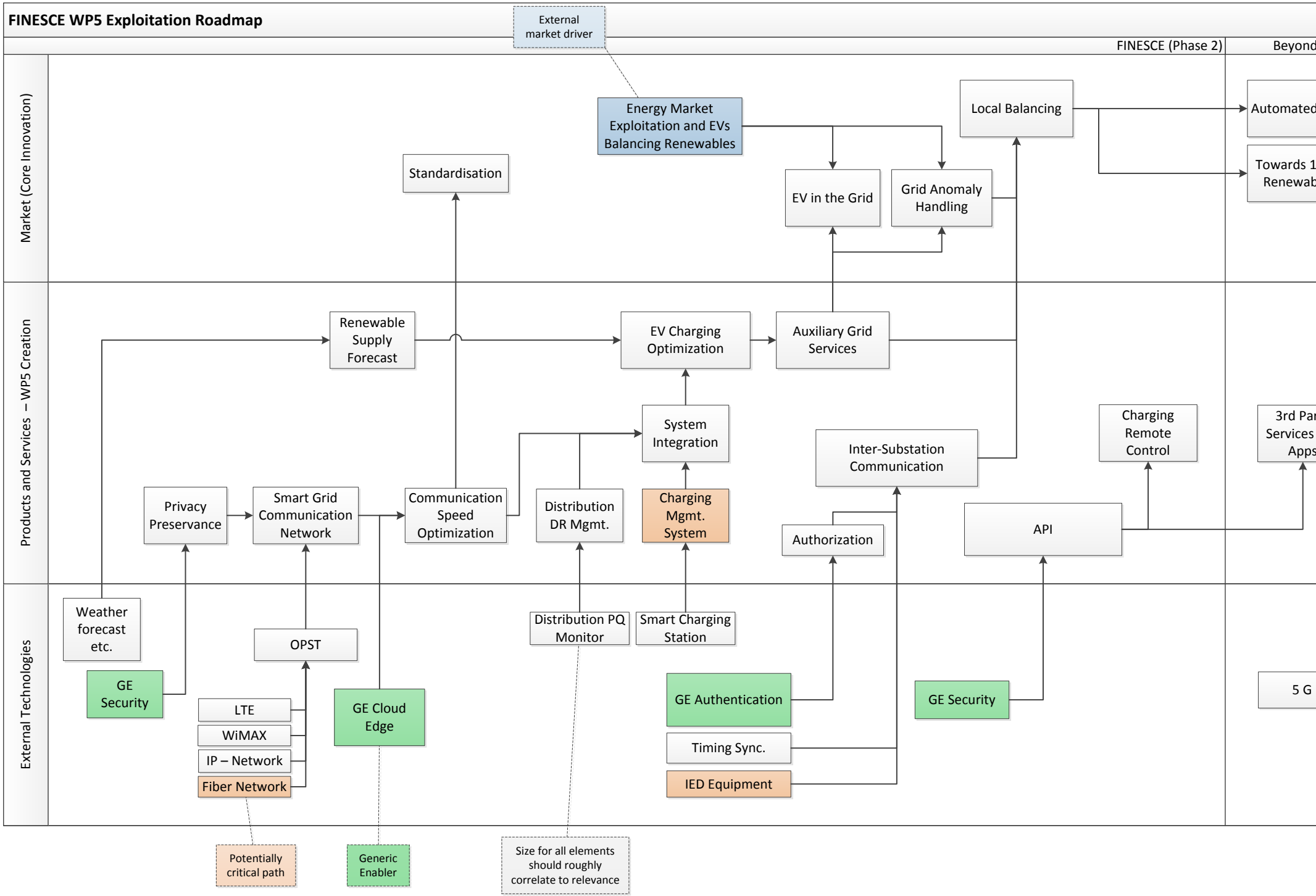


FINESCE WP2 Stream 2 Exploitation Roadmap – Version 0.1 (Sketch)
Last updated: 12.09.2013
Responsible: Julian Krenge, Marco Roscher, FIR



FINESCE WP3 Exploitation Roadmap – Version 0.2 (Draft)
Last updated: 26.07.2013
Responsible: Julian Krenge, Marco Roscher, FIR


FINESCE WP4 Exploitation Roadmap
External market driver
FINESCE (Phase 2)
Beyond (Phase 3)
Market (Core Innovation)
EU 202020 Targets
Terni increase renewables
Minimization of grid instability (power flows and loses) / DSO side
Demand flexibility
Maximization of incomes / Energy retailer side
Maximization of benefits / Consumer side
Prosumer involvment
Increase of the usage of REs
New Aggregator business model for the energy market
Products and Services – WP4 Creation
Social events repository
Weather data
Metering data
Energy dynamics
Contract information
Integegration of subjective data
Issue detector
Resolution plan
Regulation compliance rule engine
Contract mgm.
Contract tailor
Integration (Contract Manager)
Interactive marketplace (Interface to End-User)
API
Validation
External Technologies
GE Context broker
GE Big Data Analysis
GE CEP
GE Application Meshup
GE Data Handling
GE Security


FINESCE WP5 Exploitation Roadmap
External market driver
FINESCE (Phase 2)
Beyond
Market (Core Innovation)
Products and Services – WP5 Creation
External Technologies
Energy Market Exploitation and EVs Balancing Renewables
Local Balancing
Automated
Towards 1 Renewab
Standardisation
EV in the Grid
Grid Anomaly Handling
Renewable Supply Forecast
EV Charging Optimization
Auxiliary Grid Services
System Integration
Inter-Substation Communication
Charging Remote Control
3rd Par Services Apps
Privacy Preservance
Smart Grid Communication Network
Communication Speed Optimization
Distribution DR Mgmt.
Charging Mgmt. System
Authorization
API
Weather forecast etc.
GE Security
OPST
LTE
WiMAX
IP – Network
Fiber Network
GE Cloud Edge
Distribution PQ Monitor
Smart Charging Station
GE Authentication
Timing Sync.
IED Equipment
GE Security
5 G
Potentially critical path
Generic Enabler
Size for all elements should roughly correlate to relevance

4. Conclusions

The presented roadmaps depict the current status of the design within the different trials. This status will evolve as the Work Packages further investigate the Generic Enablers and their possible deployment in the trial architectures. Another iteration of this deliverable will be created by Month 18 to reflect the changes and updates on the individual roadmaps as well as to illustrate and document the consolidated FINESCE roadmap.

However, in the course of the creation of the roadmaps some synergies between different trial sites could already be identified. Those mainly refer to Generic Enablers used by different Work Packages – e.g. the GE Complex Event Processing to be used in WP 1, 3 and 4, which requires deep understanding of CEP as such and the aspects of technical integration – or other external technologies – e.g. the Develco box used by WP 1 and 2. As identified in the roadmap, in WP 3 and 4 a similar development (automatic issue detection) is being done, but with different application areas.

The roadmaps will further be elaborated in the coming months of the project to guarantee a consistent and up-to-date status description of the whole FINESCE trial sites.

5. List of Abbreviations

API	Application programming interface
B2B	Business-to-business
CEP	Complex Event Processing
DER	Distributed Energy Resource
DSE	Domain Specific Enabler
FI	Future Internet
GE	Generic Enabler
GEi	Generic Enabler Implementation
HTTP	Hypertext Transfer Protocol
IaaS	Infrastructure as a Service
ICT	Information and communications technology
IP	Internet Protocol
KPI	Key performance indicator
PaaS	Platform as a Service
SaaS	Software as a Service
SME	Small and medium enterprises
V2G	Vehicle-to-grid
VPP	Virtual Power Plant
WP	Work Package